※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. A rigid bar AB, pinned at end A, is supported by a steel wire CD and loaded by a force P at end B (see Figure 1-1). The stress-strain behavior of the steel wire may be represented approximately by the bilinear stress-strain diagram shown in the Figure 1-2. The length of the wire is $L = 1.0$ m and its area is $A = 20$ mm². Calculate the displacement δ_B at end B when the applied force $P = 6$ kN. **(25%)**
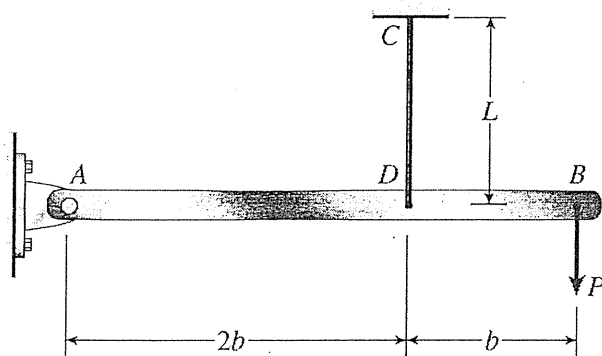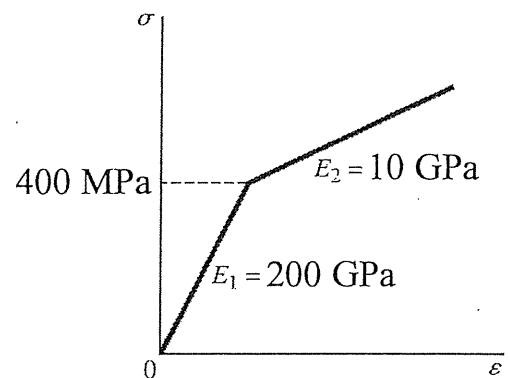

Figure 1-1

Figure 1-2

2. A timber beam AB of length L and rectangular cross section carries a uniformly distributed load w and is supported as shown.

   (a) Determine the ratio τ_m / σ_m of the maximum values of the shearing and normal stresses in the beam, in terms of the depth h and the length of the beam L. **(20%)**

   (b) Determine the depth h and the width b of the beam, knowing that $L = 10$ m, $w = 5$ kN/m, $\tau_m = 0.5\,\text{MPa}$, and $\sigma_m = 10\,\text{MPa}$. **(5%)**
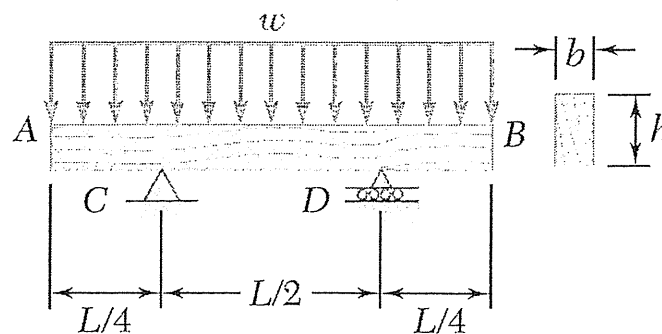

Figure 2

3. A cantilever beam with rectangular cross section ($b = 0.3$ m, $h = 1.0$ m) supports load P at its free end. Point A is at distance $c = 1.0$ m from the free end and distance $d = 0.6$ mm up from the bottom. Determine the maximum load of P (unit: kN) so that the magnitudes of the principal stresses σ_1 at point A should exceed no more than 1.8 MPa. **(25%)**
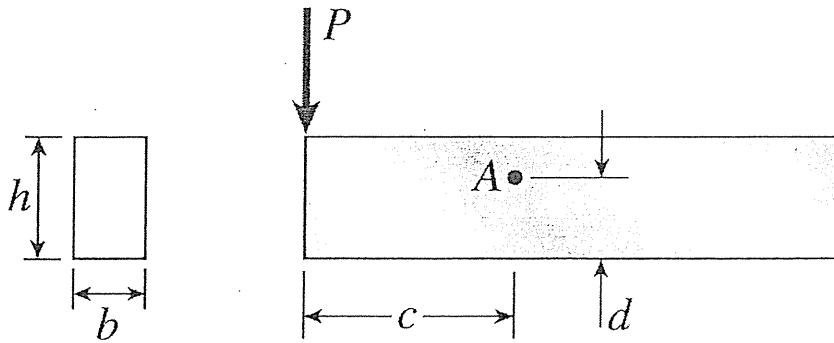

Figure 3

4. The figure 4 shows an idealized structure consisting of bars AB and BC which are connected using a hinge at B and linearly elastic springs at A and B. Rotational stiffness are denoted β_R and $\beta_R/2$, and translational stiffness is denoted β. Find the critical buckling load P_{cr} of the structure system. **(25%)**
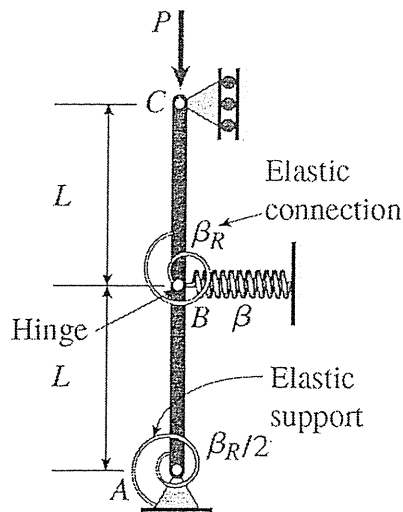

Figure 4